In the Claims

Please amend Claims 1, 3, 5, 21, 23 and 25 as shown in the following listing.

1   1. (Currently Amended). An apparatus, for measuring concentration, distribution and flow of solids

2   suspended in a flowing liquid, which comprises:

3   a transmitter emitting at least one directional beam of an acoustical waveform;

4   at least one detector receiving echo signals of said waveform backscattered from said solids;

5   means for gathering measured intensity ~~value~~ values of said echo signals;

6   means for measuring Doppler frequency shifts of said echo signals; and

7   data processing equipment comprising means for translating said intensity values into

8   concentration values of said solids, and means for interpreting said frequency shifts into flow

9   measurements of said solids.

1   2. (Original). The apparatus of Claim 1, wherein said flowing liquid is contained in a conduit

2   having a directional flow, and said transmitter and detector are located inside said conduit.

1   3. (Currently Amended). An apparatus, for measuring concentration, distribution and flow of solids

2   suspended in a flowing liquid, which comprises:

3   a transmitter emitting at least one directional beam of an acoustical waveform;

4   at least one detector receiving echo signals of said waveform backscattered from said solids;

5   means for gathering measured intensity values of said echo signals;

6   means for measuring Doppler frequency shifts of said echo signals;

7   data processing equipment comprising means for translating said intensity values into

3

8   concentration values of said solids, and means for interpreting said frequency shifts into flow

9   measurements of said solids;

10   wherein said flowing liquid is contained in a conduit having a directional flow, and said

11   transmitter and detector are located inside said conduit; and

12   ~~The apparatus of Claim 2, wherein~~ said transmitter emits at least a first pair of said beams

13   from substantially the same location, a second beam in said pair being aimed downstream from a

14   first beam and at a longitudinal angle from said first beam.

1   4. (Original). The apparatus of Claim 3 which further comprises a second of said pair of beams

2   aimed at a transversal angle from said first pair of beams.

1   5. (Currently Amended). An apparatus, for measuring concentration, distribution and flow of solids

2   suspended in a flowing liquid, which comprises:

3   a transmitter emitting at least one directional beam of an acoustical waveform;

4   at least one detector receiving echo signals of said waveform backscattered from said solids;

5   means for gathering measured intensity values of said echo signals;

6   means for measuring Doppler frequency shifts of said echo signals;

7   data processing equipment comprising means for translating said intensity values into

8   concentration values of said solids, and means for interpreting said frequency shifts into flow

9   measurements of said solids; and

10   ~~The apparatus of Claim 1 which further comprises~~ means for generating samplings of said

11   echo signals corresponding to discrete volumes of said liquid distributed along said beam.

1   6. (Original). The apparatus of Claim 5, wherein said means for translating comprises means for

2   calibrating said intensity values by imputing site specific environmental information.

1   7. (Original). The apparatus of Claim 5, wherein said means for translating further comprises

2   means for entering suspended solids concentration values obtained from a previous measurement.

1   8. (Original). The apparatus of Claim 6, wherein said site specific environmental information

2   comprises water temperature, salinity and acoustical system constants, and an echo signal assignment

3   ratio between concentration and particle size.

1   9. (Original). The apparatus of Claim 6, wherein said data processing equipment further comprises

2   program means for adjusting at least one calibration parameter in translating intensity value from one

3   of said volumes using values obtained from another volume along the same beam.

1   10. (Original). The apparatus of Claim 6, wherein said means for calibrating comprises means for

2   automatically entering information, and means for manually entering information.

1   11. (Original). The apparatus of Claim 5, wherein said means for translating comprise means for

2   computing a mass concentration of solid $M_{(s)}$ per unit volume at a range r according to the formula:

3
$$Log_{10} M(r) = K_s + S\left[dB + 2r\left(\alpha_w + \alpha_s\right)\right]$$

4   wherein K_s is a site and instrument constant,

5   S is a relative backscattered coefficient defining the relationship between solid

6   concentration and particle size,

7   dB is the measured relative backscattered intensity,

8   α_w is a water attenuation coefficient, and

9   α_s is an attenuation coefficient due to the presence of solids.

1   12. (Original). The apparatus of Claim 11, wherein said means for translating further comprise:

2   means for using $M_{(R)j}$ values obtained in connection with one of said volumes to compute said

3   attenuation coefficient α_s; and,

4   means for imputing said α_s value in translating said intensity value into an $M_{(R)j}$ value for the

5   next of said volume farther away from said transmitter.

1   13. (Original). The apparatus of Claim 4 which further comprises means for generating samplings

2   of said echo signals corresponding to discrete volumes of said liquid distributed along said beams.

1   14. (Original). The apparatus of Claim 13, wherein said means for translating comprises means for

2   calibrating said intensity values by imputing site specific environmental information.

1   15. (Original). The apparatus of Claim 13, wherein said means for translating further comprises

2   means for entering concentration values obtained from a previous measurement.

1   16. (Original). The apparatus of Claim 15, wherein said site specific environmental information

2   comprises water temperature, salinity and acoustical system constants, and echo signal assignment

3   ratio between concentration and particle size.

1   17. (Original). The apparatus of Claim 14, wherein said data processing equipment further

2   comprises program means for adjusting at least one calibration parameter in translating intensity

3   value from one of said volumes using values obtained from another volume along the same beam.

1   18. (Original). The apparatus of Claim 14, wherein said means for calibrating comprises means for

2   automatically entering information, and means for manually entering information.

1   19. (Original). The apparatus of Claim 13, wherein said means for translating comprise means for

2   computing a mass concentration of solid $M_{(R)}$ per unit volume at a range r according to the formula:

3
$$Log_{10} M(r) = K_s + S\left[dB + 2r\left(\alpha_w + \alpha_s\right)\right]$$

4   wherein K_s is a site and instrument constant,

5   S is a relative backscattered coefficient defining the relationship between solid

6   concentration and particle size,

7   dB is the measured relative backscattered intensity,

8   α_w is a water attenuation coefficient, and

9   α_s is an attenuation coefficient due to the presence of solids.

1   20. (Original). The apparatus of Claim 13, wherein said means for translating further comprise:

2   means for using M_r values obtained in connection with one of said volumes to compute said

3   attenuation coefficient α_s; and

4   means for imputing said α_s value in translating said intensity value into an $M_{(R)}$ value for the

5   next of said volume farther away from said transmitter.

1   21. (Currently Amended). A method for measuring concentration, distribution and flow of solids

2   suspended in a flowing liquid, which comprises:

3   emitting at least one directional beam of an acoustical waveform across said liquid;

4   ~~detector~~ receiving range-gated samplings of echo signals of said waveform backscattered

5   from said solids;

6   gathering measured intensity value of said ~~echo~~ samplings signals;

7   measuring Doppler frequency shifts of said ~~echo~~ samplings signals; ~~and~~

8   translating said intensity values into estimated concentration values of said solids; and

9   interpreting said frequency shifts into flow measurements of said solids.

1   22. (Original). The method of Claim 21, wherein said flowing liquid is contained in a conduit

2   having a directional flow, and said transmitter and detector are located inside said conduit.

1   23. (Currently Amended). A method for measuring concentration, distribution and flow of solids

2   suspended in a flowing liquid, which comprises:

3   emitting at least one directional beam of an acoustical waveform across said liquid;

8

4 receiving echo signals of said waveform backscattered from said solids;

5 gathering measured intensity value of said echo signals;

6 measuring Doppler frequency shifts of said echo signals;

7 translating said intensity values into concentration values of said solids;

8 interpreting said frequency shifts into flow measurements of said solids;

9 wherein said flowing liquid is contained in a conduit having a directional flow, and said

10 transmitter and detector are located inside said conduit; and

11 ~~The method of Claim 22, wherein~~ said emitting comprises transmitting at least a first pair

12 of said beams from substantially the same location, a second beam in said pair being aimed

13 downstream from a first beam and at a longitudinal angle from said first beam.

1 24. (Original). The method of Claim 23 which further comprises emitting a second of said pair of

2 beams aimed at a transversal angle from said first pair of beams.

1 25. (Currently Amended). A method for measuring concentration, distribution and flow of solids

2 suspended in a flowing liquid, which comprises:

3 emitting at least one directional beam of an acoustical waveform across said liquid;

4 receiving echo signals of said waveform backscattered from said solids;

5 gathering measured intensity value of said echo signals;

6 measuring Doppler frequency shifts of said echo signals;

7 translating said intensity values into concentration values of said solids;

8 interpreting said frequency shifts into flow measurements of said solids; and

9   ~~The method of Claim 21 which further comprises~~ generating samplings of said echo signals

10   corresponding to discrete volumes of said liquid distributed along said beam.

1   26. (Original). The method of Claim 25, wherein said translating comprises calibrating said

2   intensity values by imputing site specific environmental information.

1   27. (Original). The method of Claim 25, wherein said translating further comprises entering

2   suspended solids concentration values obtained from a previous measurement.

1   28. (Original). The method of Claim 27, wherein said site specific environmental information

2   comprises water temperature, salinity and acoustical system constants, and echo signal assignment

3   ratio between concentration and particle size.

1   29. (Original). The method of Claim 26 which further comprises adjusting at least one calibration

2   parameter in translating intensity value from one of said volumes using values obtained from another

3   volume along the same beam.

1   30. (Original). The method of Claim 26, wherein said calibrating comprises automatically entering

2   information, and manually entering information.

1   31. (Original). The method of Claim 25, wherein said translating comprise computing a mass

2   concentration of solid $M_{(\mathbb{R})}$ per unit volume at a range r according to the formula:

3
$$Log_{10} M(r) = K_s + S[dB + 2r(\alpha_w + \alpha_s)]$$

4   wherein K_s is a site and instrument constant,

5   S is a relative backscattered coefficient defining the relationship between solid

6   concentration and particle size,

7   dB is the measured relative backscattered intensity,

8   α_w is a water attenuation coefficient, and

9   α_s is an attenuation coefficient due to the presence of solids.

1   32. (Original). The method of Claim 31, wherein said translating further comprise:

2   using M_r values obtained in connection with one of said volumes to compute said attenuation

3   coefficient α_s; and

4   imputing said α_s value in translating said intensity value into an $M_{®j}$ value for the next of said

5   volume farther away from said transmitter.

1   33. (Original). The method of Claim 24 which further comprises samplings of said echo signals

2   corresponding to discrete volumes of said liquid distributed along said beams.

1   34. (Original). The method of Claim 33, wherein said translating comprises calibrating said

2   intensity values by imputing site specific environmental information.

1   35. (Original). The method of Claim 33, wherein said translating further comprises entering

2   concentration values obtained from a previous measurement.

1   36. (Original). The method of Claim 35, wherein said site specific environmental information

2   comprises water temperature, salinity and acoustical system constants, and echo signal assignment

3   ratio between concentration and particle size.

1   37. (Original). The method of Claim 34, wherein said data processing equipment further comprises

2   program adjusting at least one calibration parameter in translating intensity value from one of said

3   volumes using values obtained from another volume along the same beam.

1   38. (Original). The method of Claim 34, wherein said calibrating comprises automatically entering

2   information, and manually entering information.

1   39. (Original). The method of Claim 33, wherein said translating comprise computing a mass

2   concentration of solid $M_{(R)}$ per unit volume at a range r according to the formula:

3
$$Log_{10} M(r) = K_s + S\left[dB + 2r\left(\alpha_w + \alpha_s\right)\right]$$

4   wherein K_s is a site and instrument constant,

5   S is a relative backscattered coefficient defining the relationship between solid

6   concentration and particle size,

7   dB is the measured relative backscattered intensity,

8   α_w is a water attenuation coefficient, and

.9 α_s is an attenuation coefficient due to the presence of solids.

1   40. (Original). The method of Claim 39, wherein said translating further comprise:

2   using M_r values obtained in connection with one of said volumes to compute said attenuation

3   coefficient a_s; and

4   imputing said a_s value in translating said intensity value into an $M_{®)}$ value for the next of said

5   volume farther away from said transmitter.